# SWOV in 1976 and 1977

INSTITUTE FOR ROAD SAFETY RESEARCH SWOV

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# Contents



# The Institute

The Institute for Road Safety Research SWOV was founded in 1962. Its object is, on the basis of scientific research, to supply the authorities with data for measures aiming at promoting road safety. The information obtained from this scientific research is disseminated by SWOV, either as individual publications, or as articles in periodicals or via other communication media.

SWOV's council consists of representatives of various Ministries, of industry and of leading social institutions.

The Bureau is managed by E Asmussen, SWOV's Director. Its departments include: Research Policy, Research Coordination, Research Services, Theoretical Research Pre-crash Projects, Applied Research Pre-crash Projects, Crash and Post-crash Research and Information.

# Preface

Society is in greater need of brief and clear information. This is why, in addition to the SWOV Annual Report, which is only published in Dutch, we have reviewed activities of importance to a wide circle of readers.

In this brochure SWOV in 1976 and 1977 a choice has been made of subjects on which reports, articles or other publications have appeared in the past two years. Research projects that attracted wide interest are also included. This form of reporting has enabled us to write on a number of subjects in greater detail than has been customary in our annual reports.

With each subject, a list of the relevant literature is given. At the end there is a complete list of all SWOV publications in 1976 and 1977. These publications will be gladly supplied free of charge, on request at SWOV's Information Department.

This review will in future be sent to all those who previously received the complete SWOV Annual Report.

# Foreword

During the past two years, the earlier initiatives with a view to promote road safety had a great influence on SWOV's work.
In 1974, Mr.Westerterp, the then Minister of Transport, appointed a Road Safety Directorate and in 1975 he presented a Road Safety Policy Plan to Parliament.
Next, a considerable number of measures were adopted – including the wearing of crash helmets by moped riders and of seatbelts by motorists, the drinking and driving legislation of 1st November 1974, the promotion of cycle routes and residential yards – while numerous other measures went into the planning stage. SWOV had a share in this in the form of policy-preparing research.

The past few years have seen major changes. The call of society for a renewed road safety policy plan has been answered in principle.
The Road Safety Directorate, designated by the Minister to prepare, stimulate and co-ordinate road safety policy quickly produced a series of initiatives. Scientific research was also more closely involved in the problems of road safety policy, so that SWOV's assistance was called for more often.
In order to respond quickly and efficiently to policy questions, SWOV has to have a large volume of data on the traffic process and road safety. These data, which often have to cover a period of five years or more, are obtained by basic research. Basic research anticipates policy-preparing research focused on the authorities' direct needs. Without the information obtained from basic research, it is often impossible to undertake policy-preparing research or to make recommendations.
It should be borne in mind that it will become more and more difficult to find new measures which are simple and inexpensive yet very effective. Examples of such measures are the compulsory wearing of crash moped helmets and car seatbelts already mentioned. In order to make road traffic safer in the future, structural measures in particular will be needed. Because of their complexity, such measures are impossible without making use of the store of scientific knowledge. The – usually high – cost of a structural measure will have to be carefully weighed against the anticipated benefits. In other words: before such a measure is carried out, it will have to be known to what extent it can reduce human suffering and economic loss caused by road traffic accidents.

The increasing number of questions put to SWOV by the authorities means that additional resources and manpower have to be used for policy preparing research. In view of present economic conditions and the (consequent) official economies, such resources and manpower would have to be withdrawn from basic research. But this would have very detrimental long term effects for lack of nourishment from basic research, policy-preparing research will cost more money and especially time. This will prevent an adequate response to current trends in road safety. It is particularly important, therefore, that there should be a balance in SWOV's research programme between basic research and policy-preparing research.

The talks and negotiations with government authorities on these problems have left their imprint on SWOV's administrative and management policy which is, of course, aimed at obtaining the necessary funds.
But it might be rather premature to expect the problem of 'necessary effort versus too few funds' to be solved quickly, in view of the present economic constellation.

Th J Westerhout
Chairman Institute for Road Safety Research SWOV

# Introduction


For many years road traffic hazards have been one of the greatest threats to public health. As long ago as 1966, a memorandum from the Ministry of Social Affairs and Public Health said: 'Three causes of death cause particular anxiety, both on account of the number of deaths and the rapid increase therein: arteriosclerotic heart disease, lung cancer and road accidents'. The many measures adopted in recent years to promote road safety have at least stopped the rapid increase in road accidents. The 2432 road deaths in 1976, however, clearly show that the problem of road safety has by no means been disposed of.

Human behaviour plays a central role in road-traffic accidents. The road user's behaviour is determined not only by his temporary and permanent characteristics, but also by the characteristics of his vehicle, the road and the surroundings. There is constant interaction between all these factors, and certain combinations of them may occur which make it difficult if not impossible for a road user to go on behaving safely. A tired truck driver, for instance, will generally find it more difficult than a fit driver to take a sudden sharp bend in a road safely.
It is SWOV's task to find out the critical combinations of factors that may cause accidents. A major part is therefore

reserved for this in the research programme.
If such research is to be really efficient, an integrated approach is needed by technical scientists and behavioural and physical scientists.
As knowledge arising from such research grows, traffic facilities – such as roads and vehicles – can be better attuned to human characteristics. Furthermore, codes of conduct can be drawn up for safer use of these facilities by the road user. Let us return to the simple example mentioned above: when roads are constructed, sharp bends will have to be avoided as much as possible; on existing roads sudden sharp bends will have to be straightened out or at least be indicated in good time; in addition, rules have been made for truck drivers forbidding them to be at the wheel too long (the tachograph is one means of checking whether these driving-time rules are observed).

The brochure now before you tries to give an idea of the contributions made to road safety by SWOV workers during these years by means of publications. They do not, of course, give the complete picture of SWOV's work. Various new projects have recently been started, while others were still well under way. Moreover, SWOV has contributed by way of scientific recommendations to the functioning of many national and international working groups and committees.
A full review of these activities is given in the official annual report published each year.

The foregoing has shown that road-safety research itself is a complex activity. But it is made more difficult still because the promoting of road safety is not, of course, backed by unlimited financial resources. Road traffic hazards are not the only social need that has to be alleviated. The authorities will have to allocate the available means as well as possible over a multiplicity of welfare and prosperity sectors. Consequently, road-traffic hazards cannot be fought on all fronts at once, but the authorities are compelled to give some aspects priority over others. The Road Safety Policy Plan shows that in the years ahead the emphasis will be on reducing road traffic hazards in built up areas, especially as regards slow traffic. SWOV will also have to allow for this. In other words: the objectives of the Minister co-ordinating road safety will have to be 'translated' into a research programme. Such a programme will have to be carried out within a given budget and with limited manpower. The time available to carry it out is not unlimited either. If it takes too long there is a risk of the results no longer being applicable to the current situation.

The research results will have to be presented in such a way that they can be used by the policy making bodies in the adoption of measures.

It is of primary importance, therefore, for policy and research to be familiar with one another's work and problems. Only in that case can a kind of no man's land between policy and research be avoided. In recent years, therefore, SWOV has made a special effort to encourage and intensity communication with the authorities. A number of scientific workers have in fact even had the special duty in recent years of converting policy questions we have received as effectively as possible into research questions and to translate the research results into recommendations for measures needed by society, and hence by the authorities as well.

E Asmussen
Director Institute for Road Safety Research SWOV

*Congress on 'Future in safety';*
*from left B.Schultsz, Th.van der Meer,*
*Pieter van Vollenhoven, E.Asmussen,*
*T.E.Westerterp, Th J.Westerhout.*

# Future in safety

On 18th May 1976, SWOV organised a congress at the RAI International Congress Centre, Amsterdam, on 'Future in Safety'. A number of speakers gave their views on different aspects and consequences of the Road Safety Policy Plan presented to Parliament by the Minister of Transport and Waterways in 1975.
In the early years of SWOV's existence, policy asked scientific research for rapid solutions to isolated problems. Now, the authorities want not only rapid recommendations but also results of more comprehensive studies envisaging structural measures. For such measures, which are very complicated and highly expensive and moreover drastically affect traffic structures, extreme caution is called for, and this means thorough research.

The Congress was opened by the Minister of Transport and Waterways, Mr T.E.Westerterp. He spoke on the relationship between administrative policy and scientific research in the fight against road traffic hazards. He said that there was all too often a difference between what was needed for policy making and what is supplied by research. To avoid friction on this, it is important to discuss beforehand what one can reasonably expect regarding the practical value of scientific research results. He said that the value of scientific research lies in its independence. But there has to be agreement about the objectives of policy and research and it is essential for policy and scientific research to understand one another's problems.

The Minister was followed by Mr.E. Asmussen, director of SWOV. The focal point of his address was the question of how scientific research can contribute to achievement of the objectives of road-safety policy. In the first place, this requires an accurate description of the problem of road-traffic hazards. The lack of such a description so far has been one of the main reasons why policy intentions always lag behind actual developments.
Man's characteristics, limitations and possibilities and his behaviour on the road are and continue to be the binding element in a coherent policy. If a policy is based on incorrect anticipations about the effect of measures on human behaviour, then that policy is doomed to failure. A major influence on the form of traffic facilities are the standards and guidelines established by the authorities. These standards and guidelines at present are often arrived at by consultation between road authorities. The road authorities' practical experience is so far, however, hardly based on scientifically acquired knowledge of, say, the relationship between accidents and road design elements, while the effect of the standards and guidelines is hardly ever evaluated, if at all.
The establisment of standards and guidelines therefore requires a major contribution from road-safety research, was Mr.Asmussen's conclusion.
At the present time, when the authorities have to economise, it is necessary to have as much certainty as possible that the measures that are to be adopted will also be effective. Scientific research can make a very important contribution to this, while its cost represents only a fraction of the overall cost of introducing a structural measure. good (hence effective) measures prove inexpensive in the long run. They largely pay for themselves by the saving on accidents. It should therefore be fully appreciated, said Mr.Asmussen, that most traffic facilities, especially the road system, have a very long useful life.
Hence, economic recessions ought not to affect the quality of these facilities. This implies that use should be made of the knowledge gained in scientific research.

Next, Mr P Allewijn, Road Safety Director at the Ministry of Transport and Waterways, spoke about the Road Safety Policy Plan. He said the Policy Plan had been drawn up in the conviction that road hazards were a social evil of the first order which had to be

*A 'road of their own' for cyclists and moped riders.*

# Ten years road safety in The Netherlands

suppressed not only relatively but absolutely as well.
But he also made it clear that road-safety policy should not be applied at the expense of the necessary and desirable mobility. He did see possibilities of reducing the need for travel, for instance by giving people the opportunity to live closer to their jobs. This would reduce the need to travel which would in turn reduce the risk of accidents and casualties.
He then indicated four areas in which the fight against traffic hazards would be fought simultaneously. The first was that of the need for mobility already mentioned and the way this could be dealt with, in other words: what modes of travel should be encouraged and which retarded? The second was that of travel conditions, the traffic facilities. In this area, the focal point should be upon road 'categorisation' and traffic segregation. The third area was that of training, selection, education and information for road users. The fourth area was that of legislation, law enforcement and traffic supervision. The last two areas were closely related: in both of them, an effort was being made to influence road-users' behaviour directly. But little was known about the possibilities of this. In the fight in these four areas, special attention would be paid to road safety in built up areas, especially with a view to protecting pedestrians, cyclists and moped riders.

In the afternoon programme, SWOV workers explained some practical research projects. The first subject was that of pedestrian safety and the search for methods of establishing and predicting this objectively. The focal point was a new method based on traffic conflicts analysis. The next subjects were the danger of lighting columns in impacts involving cars and road safety in rural areas. Lastly, accidents on wet road surfaces were gone into and the state of research into technical measures for reducing the danger of skidding was set forth.

There was considerable interest in this SWOV congress. It was attended by 458 persons, most of them involved in Dutch road traffic policy. Nearly all daily papers, the radio, television and the Polygoon newsreel gave ample coverage.

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**SWOV Congress: Future in Safety.**
Programme and texts of the speeches at the SWOV Congress 'Future in Safety', held on 18th May 1976 at the RAI International Congress Centre, Amsterdam. (Only in Dutch: SWOV, 1976)

On the occasion of the congress 'Future in Safety' SWOV brought out the Dutch version of the publication 'Ten Years Road Safety in The Netherlands'.
It described the extent and trends in road traffic and in road safety between 1964 and 1975. Much attention is devoted to the gratifying decrease in the number of road deaths in 1974 and 1975. A knowledge of the causes of this decrease is very valuable to those who have to determine road-safety policy in The Netherlands. But a wider public, too, was very interested in this publication. This is evident from the fact that not only 1400 copies were despatched to addresses on the mailing list but that another 800 persons and institutions wished to note its contents.

The publication shows that the number of road deaths in 1974 was about 20% lower and in 1975 even 24% lower than the previous years' trend would have suggested. Besides extraneous influences, these decreases are largely due to official measures. Extraneous influences were, for example, the effects of the energy crisis still evident in 1974, and the decline in the percentage of 'new' car drivers. Of the official measures that led to a reduction in deaths in 1974 and 1975, special mention should be made of the compulsory wearing of seatbelts and moped crash helmets. Without an increase in

seatbelt wearing, there would probably have been 200 more deaths in 1975 than was actually the case. Owing to the increase in wearing of moped helmets there were probably 50 fewer deaths in 1974 and about 100 fewer in 1975 than if helmets had not been worn. Other possible contributory measures in the reduction in road deaths are the overall speed limits on roads outside built-up areas (February 1974) and the introduction of new legislation on drinking and driving (November 1974).

In the publication Ten Years Road Safety in The Netherlands, SWOV not only analyses the trend in road safety, but also makes proposals for improved gathering of data, in order the the effect of measures can be measured more accurately in the future, but in particular in order to make this effect predictable.

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**Ten Years Road Safety in The Netherlands.** A description of the extent and trends of road traffic and road safety in The Netherlands since 1964.
J van Minnen, A.Blokpoel and F C Flury.
(In Dutch: SWOV, 1976; English version: Publication 1978-1E, SWOV, 1978.

**The danger of driving while intoxicated**

Not only in The Netherlands but in other countries as well there has been considerable interest in recent years in the subject of drinking and driving. Very many research projects, symposia, conferences and publications testify to this. In The Netherlands, SWOV published a study of the literature on the subject in 1967. SWOV also had research carried out by the Institute for Perception TNO and the Criminological Institute of Groningen State University. In 1970, SWOV started a series of research projects into driving and drinking habits, five of which were carried out in 1976. They also went into the value of breath analysers for scientific purposes.

In 1976, in addition to the Roadside surveys on drinking and driving, SWOV made a new study of the literature which can be regarded as a supplement to that in 1967. A large number of Dutch and other research projects were critically examined and their results put in a systematic form.
The study disclosed that it is difficult to assess in Europe, and especially in The Netherlands, how many road deaths are attributable to drinking. The reason is that official records are incomplete and may give a distorted picture. It is clear, however, that the risk of accident involvement is greater the more a driver has been drinking. But this does not apply equally to all drivers. There are indications that the accident risk for young drivers greatly increases even after little drinking, while this does not apply to older people. This is one reason why a specific limit can not be given above which it is not advisable to drive from the road safety aspect. But it can roughly be said that there is a pronounced increase in the accident risk if the blood alcohol concentration is between 50 and 100 mg per 100 ml of blood.
In The Netherlands it is forbidden to drive if the concentration exceeds 50 mg/100 ml. The answer to the question of how frequently people drive after drinking can be obtained by examining the degree of drinking by a random sample of road users.
For such research, of which SWOV's Roadside surveys on drinking and driving is an example, there is increasing interest internationally. Until recently, research was concentrated on those convicted of driving while intoxicated. There are now enough indications that the results of such research do not automatically apply to all drivers who drink occasionally.

**Drinking by Dutch motorists**

While there was a clear tendency for the number of road deaths to decline from 1973 to 1975, there has been an in-

crease again since 1976. Many people related this to increasing alcohol consumption by the Dutch and assumed that more and more motorists drove while drunk. The drinking and driving act of 1st November 1974, which made it an offence for drivers to have a higher blood alcohol concentration than 50 mg per 100 ml blood is said to have largely lost its effect. This was very much the view of the police.

The SWOV report on Drinking by Motorists, a report on the roads de surveys on drinking and driving, had already given indications in this direction. This report, published in 1977, contains the results of comparative research into drinking and driving by Dutch motorists in the years 1970, 1971, 1973, 1974 and 1975.
In the autumn in each of these years, various SWOV teams went into the field at various places in the country to check drinking by motorists. The investigations were made on Friday, Saturday and Sunday between 10 0 p.m. and 4 0 a.m., mostly for ten weekends in succession. The reason for choosing weekend nights was a practical one. According to the Central Bureau of Statistics in The Netherlands CBS, it is then that most accidents involving alcohol occur. This means that the results for the various years can be compared, but that they do not give an overall picture of drinking by Dutch motorists. On other days of the week motorists drink less in fact.
During the research, the police stopped a motorist at random every ten minutes and he was asked whether he would co-operate in the research project. If so, his BAC (Blood Alcohol Concentration) was determined. Motorists who had been drinking too much were not summoned by the police but were taken home by taxi by SWOV.
Besides the BAC, a note was made of such details as the motorist's driving experience, age and sex, time of stopping, origin and destination.
The most important conclusion from the research is that from 1970 to 1973 there was a rising tendency in drinking by motorists. At weekend nights immediately after the 1st November 1974 legislation was introduced, there were hardly any drinking drivers. In 1975, the percentage of motorists with a BAC of 50 mg/100 ml (the legal limit since 1st November 1974) or higher was well below the level prior to the introduction of the Act, although there was four times as much drinking as compared with immediately after the Act came into force. It is difficult to say what the percentage would have been in 1975 if there had been no new legislation. It would probably have been at least the same as in 1973. Nor is it known what effect the Act had on drinking by motorists during the rest of the week.

Although SWOV did not investigate drinking by Dutch motorists in 1976, there are nevertheless indications that the effect of the Act has declined further still. The Central Bureau of Statistics in The Netherlands CBS states that accidents involving drinking increased from 3449 in 1975 to 4585 in 1976. Accidents in which a police report was drawn up on account of drinking rose from 1580 to 2282. As these discrepancies may be partly due to a change in recording methods or a different approach to detection, SWOV again investigated the drinking habits of Dutch motorists in 1977. Comparison with the previous years' findings will give irrefutable proof as to whether the new Act had become less effective or not.
Other interesting data were disclosed by the Roadside surveys on drinking and driving up to 1975. For example, out of all the motorists who had BAC's exceeding 50 mg per 100 ml at weekend nights, most were on the road between midnight and 2 0 a.m. Out of all the motorists who had drunk more than the legal limit, the biggest category in 1975 had been visiting friends (44%) and the next biggest (30%) had come from a bar, public house or a dance hall. There was some variation in drinking as between the different age groups, but this was not great nor was it the same all through the night. Furthermore, male drivers had been drinking more often than females.

And women who had been drinking had on average drunk less than men.

**Breath analysers**

The blood test is generally regarded as a very accurate method of establishing the BAC. But it is rather expensive and time-consuming; a breath test is simpler and cheaper. SWOV's Roadside surveys on drinking and driving by motorists therefore were also used to examine whether available breath analysers could be used for general scientific research purposes. This related, therefore, only to devices with which the BAC can be accurately determined and not the more commonly known tubes or bags. The indication these give is far too rough for scientific research. Such practical research has the advantage that all kinds of difficultly predictable circumstances may arise. Hence the usefulness and reliability of the breath analysers could be thoroughly tested. Laboratory tests are, of course, necessary but inadequate for complete assessment of the devices.

The conclusion from the research is that there were fairly wide variations in the quality of the devices on the market in 1975. One type could be used effectively for general scientific purposes. This, the Intoxilyzer, gives a good BAC prediction. The Intoxilyzer findings differed very little from those of the blood test. In the future these discrepancies may well be reduced. The automatic conversion of the breath alcohol concentration into the blood alcohol concentration can be improved a little. The method used so far leads to the alcohol concentration recorded in breath analysis generally being a little lower than the actual blood alcohol concentration.
For purposes other than scientific research, for example police use in screening offenders, the devices have to meet different standards.
It should be borne in mind that the Intoxilyzer is as big as an electric typewriter, has to be connected to the mains and is, moreover, fairly expensive. The more manageable devices were not yet accurate enough or free from defects. Improvement of the automatic check on the way of exhaling can certainly make such devices more accurate.
Moreover, rapid technical advances are taking place as regards breath analysers.

The Dutch version of the brochure The Intoxicated Motorist, his Drinking and Dangers was published at the end of 1977. It contains an abridged version of the results of the Roadside surveys on drinking and driving up to 1975, of research into breath analysers and of the literature research. In view of the great demand for this publication, it can be claimed to have been an unexpected success.

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**Drinking and driving; A literature study.** P.C.Noordzij. Publication 1976-4E. SWOV, 1976

**Drinking by motorists;** Report and results of roadside surveys into drinking and driving of Dutch Motorists during weekend nights in Autumn 1970, 1971, 1973, 1974, 1975. Publication 1977-2E. SWOV, 1977

**The introduction of a statutory BAC limit of 50 mg/100 ml in The Netherlands and its effect on drinking and driving habits and traffic accidents.** P.C.Noordzij. SWOV, 1977

**Breath testing.** P.C. Noordzij & J.A.G. Mulder. SWOV, 1977

**Breath analysers:** Testing of devices for determining the alcohol concentration of exhaled breath under laboratory and practical conditions. (Dutch version, SWOV, 1977; English version in print, 1978)

**The intoxicated motorist, his drinking and dangers** (Only in Dutch. SWOV, 1977)

*Signal controlled pedestrian crossings are three times as safe as ordinary zebras.*

# Pedestrians, two-wheelers and road safety

## Pedestrians

Many people say the pedestrian belongs to an almost forgotten group of road users. The tremendous, rapid increase in the number of cars in the past fifteen years and the accompanying increase in the number of road fatalities has focused attention on motorised traffic.

Pedestrians killed in traffic represent each year one-sixth of **all** road deaths, i.e. approximately 400 (in 1976).
Social changes and the growing anxiety about the environment and quality of life impelled the government to pay greater attention to the most vulnerable of all road users.
In 1969, SWOV was instructed by the authorities to investigate pedestrian safety.
At first the research was limited to measures taken in the pedestrians' interests: zebra crossings.
A SWOV report on this revealed that signal controlled crossings were three times as safe as zebra crossings.
Crossings without traffic lights, however, are much cheaper than controlled ones. An important conclusion in this SWOV report is that constructing zebra crossings in cities had by no means improved pedestrian safety.
Young children and old people could be expected to belong to the most vulnerable proportion of pedestrians. The fact

*A 'woonerf' (residential yard): motorised traffic has to adapt itself to pedestrians and cyclists.*


that these two categories together account for nearly three-quarters of all pedestrian deaths, as the SWOV report showed, was a serious indication to the authorities to give high priority to this aspect of road safety.
The Road Safety Policy Plan presented to Parliament by the Co-ordinating Minister for Road Safety at the end of 1975 (and for which SWOV provided the most important materials) gives special attention to pedestrians in traffic.
In addition to protective measures, such as facilities for crossing the road safely, attention is called to the location of schools and old people's homes, better information and training. Further elaborations mentioned are: to promote the quality of life with traffic, especially by means of residential yards, traffic segregation and the provision of cycle paths and cycle routes. The SWOV research showed that traffic training for children should be greatly improved. SWOV instructed the Traffic Research Centre of Groningen State University to evolve teaching methods. These instructions were given within the framework of SWOV research into Traffic training. In 1976 the Traffic Studies Project Group of Groningen State University published, inter alia, a review of possible research subjects and the concepts usually used in these.
The behaviour of older pedestrians is more difficult to influence. SWOV found

Factors such as reduced resilience in accidents and poorer mental and physical health can also play a part. The need, therefore, is for safer crossing facilities and in general more efficient medical guidance for this age group.

To obtain a review of pedestrian safety, statistics of accidents involving pedestrians can be studied. Another method is to analyse pedestrian behaviour in a conflict (or near miss) with another road user. A method was developed for this in collaboration with the Netherlands Institute of Preventive Medicine TNO. It is being examined whether this conflict observation method provides possibilities of locating hazardous situations and evaluating the effect of road safety measures (by means of observations before and after the measures).

Of course it is better to avoid conflict situations in advance wherever possible by creating an urban environment in which motorised road users are forced to adapt themselves to pedestrians and cyclists. Efforts are being made to take this into account in building new residential areas. Research has shown that town planning and infrastructural measures influence the residents' behaviour more than (legal) codes.

Publications by the Netherlands Institute of Preventive Medicine TNO on the use of the conflict observation method have produced considerable response and given rise to extensive scientific discussion. The main question in this is the extent to which near misses can be regarded as a criterion for accidents in residential areas.

**Cyclists, moped riders and low-speed moped riders**

Wearing of crash helmets by moped riders was made compulsory on 1st February 1975.

Since 1974 sales of mopeds had declined considerably. Dealers and industry related this to the introduction of the regulation, a new vehicle was conceived: the low-speed moped. Its maximum speed was to be that of a bicycle (20 km) and there was thus no need, it was argued, for the rider to wear a helmet. Manufacturers' and dealers' expectations ran high: they counted on selling 100,000 to 200 000 of these vehicles in forthcoming years, according to a newspaper report. And it could 'fill a gap in the moped market'.

Before consenting, the Minister of Transport and Waterways, thought it advisable to have SWOV examine the possible effects of this new means of transport on road safety. He wanted to know very quickly, compelling SWOV to make their recommendations within three months. This tour de force succeeded beyond expectation.

The report deflated a few widespread opinions. Interviews proved that the reduced demand had nothing to do with the compulsory wearing of helmets. The 16 to 20 age group are the typical moped riders. From 1969 the effect of the population explosion has been disappearing, and this groups is logically diminishing. Moreover, older people have been switching over more and more to cars or cycles for some years. In its recommendations SWOV pointed out several technical aspects of this new vehicle which were not conducive to its safety. Moreover, SWOV thought the risks for the low speed moped riders greater than those of cyclists and about as great as those for helmet-wearing moped riders. SWOV predicted that there would be little interest in the new vehicle and hence it would have little effect on road safety.

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**Pedestrian safety I.** Literature research on the effect of facilities, regulations and initiatives with a view to influencing the behaviour of pedestrians and other road users. J H Kraay. (Only in Dutch. SWOV, 1976)

**Pedestrian safety II.** Literature research into the effect of measures relating to urban infrastructures. J H Kraay. (Only in Dutch. SWOV, 1976)

# Influencing road user's behaviour

**Urban planning, pedestrians and road safety.** J.H.Kraay. SWOV, 1976

**Road traffic regulations, law enforcement and the pedestrian.** J.H.Kraay & P.C.Noordzij. SWOV, 1976

**Strategies in pedestrian road safety research.** J.H.Kraay. SWOV, 1976

**Development of a conflict observation technique.** Operationalisation, methodological problems and the use of the technique in two field situations in Delft. V.A.Güttinger (NIGP-TNO) and J.H.Kraay (SWOV). SWOV, 1976

**The low-speed moped, Safe or not?** The likely consequences upon road safety of introducing the low-speed moped. A.Blokpoel & S.Harris, M.A. (Full report only in Dutch. SWOV, 1976, English summary and conclusions availble: SWOV, 1976)

**Pedestrian road safety development and research in The Netherlands** J.H.Kraay. SWOV, 1976

**Pedestrians, two-wheelers and road safety.** A statistical comparison of pedestrian, cyclist and moped rider road-traffic fatalities in The Netherlands from 1968 to 1972. J.H.Kraay. Publication 1976-3E. SWOV, 1976

**Cycling in the dark.** An analysis of fatal bicycle accidents in The Netherlands. P.C.Noordzij, 1976

**Integration of mixed traffic in the urban environment.** J.H.Kraay, 1976

**The pedestrian as a road user.** The main points from a number of SWOV reports. J.H.Kraay et al. Publication 1977-1E. SWOV, 1977

**Some notes on 'What task is a traffic conflicts technique intended for'.** S.Oppe, 1977

**Traffic conflict analysis, a road safety research technique.** S.Oppe, 1977

In order to make the use of traffic facilities as safe as possible, the authorities draw up codes for road users. Whether road users observe these codes and what influence law enforcement and publicity campaigns have, however, was known until recently only from research in other countries. The introduction of compulsory wearing of seatbelts by motorists and crash helmets for moped riders gave SWOV an opportunity to carry out research in The Netherlands too.

Interviews and field measurements were made by SWOV both before and after compulsory wearing of crash helmets (from 1st February 1975) and seat-belts (from 1st June 1975). The findings in this and other research were combined with a general theoretical treatment of the subject of influending behaviour and embodied in a publication.

A number of remarkable conclusions can be drawn from this publication, which attracted interest in the national press. If a code is to be observed by the average road user, it will in the first place have to make a 'fair' impact. But a code must not only be 'fair', it must also be effective and clear and the prescribed behaviour must be recognisable and attractive.

If a code seems 'unfair' to the public, normal police supervision and general information will hardly improve its observance. If it is felt to be 'fair', however,

*Any helmet is better than none!*

# Safety measures in cars

more understanding can be aroused by publicity campaigns, which will improve its observance. But such campaigns will then have to be planned systematically and thoroughly prepared.

**Influencing road-user's behaviour; and its application for promoting the use of safety devices.** P.C.Noordzij. Publication 1976-1E. SWOV, 1976

**The enforcement of traffic regulations for promoting road safety.** P.C.Noordzij. (Only in Dutch. 1976)

## Seatbelts

The appearance of the publication 'Lap belts and three-point belts, a comparison of their effectiveness' (SWOV, 1975-2E), caused some commotion in The Netherlands and abroad.
The effectiveness of seatbelts can be determined only by accident research: data from such a project were taken directly from practice.
From 1968 until the beginning of 1971 SWOV carried out accident research comprising 37,000 car occupants. It compared groups of non-wearers with groups of wearers in the same impact conditions. The comparison, in which the only difference is whether seatbelts were worn or not, allows the protective effect of the seatbelt to be distilled. Although it was known that belts are worn, for instance comparatively loosely and sometimes do not encircle the body properly, effectivity figures of at least 75% with respect to fatal injuries were nevertheless found for both types of belt. The widely heard view that a lap-belt wearer is far worse off in an impact than the three-point belt wearer did not, therefore, work out in practice.

## Wearing of seatbelts

Although the value of tightly worn seatbelts is incontrovertibly established, it was found in the course of 1975 that belts were not being worn as much. In July 1975, 61% of **all** (front-seat) car occupants wore belts on outside roads compared with 56% in October. Inside built-up areas, the percentage of wearers among **all** (front-seat) car occupants fell from 48% to 41%. Interviews in 1976 showed a certain stability in wearing habits: in both July and October, about 60% of all (front-seat) car occupants wore belts outside built-up areas and about 45% inside these areas.

## Accident research

Early in 1976 SWOV launched a second, extended research project into the influence of car characteristics on the course of car accidents.
This research is again a question of the factors influending the effect of accidents on car occupants. Data on the influence of seatbelts were already known from the first accident research, but there are also safety precautions which could not be so thoroughly investigated because there were too few of them. Statistically warranted conclusions could not therefore be drawn. In the accident research carried out in 1976 and 1977 – the collecting phase of which was completed at the end of 1977 – these safety precautions do occur to an adequate extent, and it will therefore be possible to devote analyses to head supports, safety wind-

screens and safety steering columns, for instance.
A true idea of the effectiveness of these precautions can be obtained by analysing injury data in conjunction with particulars of the damage and of the nature of the accident.
Particulars of the damage were collected by special teams and data on the nature of the accident were obtained via written answers from those involved or the police.
To obtain data on injuries suffered by hospital patients, SWOV sought the assistance of doctors in the hospitals. This assistance was of great importance for collecting the injury data.
The ultimate store of data for research comprises particulars of over 8000 complete cases. The processing of these data and the subsequent analysis will be commenced in 1978.

**Lasting effects of accidents**

In The Netherlands and elsewhere little is generally known about the long-term consequences of traffic accidents. Taking the SWOV accident research as a basis, research into these lasting effects started in 1977.
In the first place, the research concerns reduced validity. This relates to the patient's physical condition at a given moment after the accident. The target group approached is ex-hospital patients who has assisted in SWOV's accident research. In the accident research, SWOV receives injury diagnosis from the respective hospital specialists.
For the collection of data on lasting effects, a period of one year after the accident was ultimately chosen. All ex-hospital patients were approached directly with a letter and an enquiry form. The total group of former hospital patients approached in this way numbers about 1500.
The information SWOV will gather in this way about the severity and nature of lasting effects will be linked up later with data already collected on the accident, vehicle and injuries to the occupants. Analysis of these will show whether the assumed connections do indeed exist. It is known, for example, that severe injury of the spine may cause severe disablement. A factor reducing the severity of such injuries is the seatbelt. Another injury frequently having lasting effects is the difficulty demonstrable whiplash syndrome. This means injury causing distortion of the cervical vertebras without there necessarily being any detectable damage on X ray photos. This injury is frequently caused by impacts from the rear. The head support might be influential in limiting such injuries and their effects. The research will show, inter alia, how effective present head supports are in reality. SWOV also expects lasting effects in patients with cranial and brain damage, with severe internal breast and stomach injuries and severe fractures. It is of course known that such injuries occur, but not how frequent the are or to what extent they have lasting effects and whether the lasting effects are caused primarily through certain impacts. SWOV hopes to answer the question whether measures are needed or are possible, and if so what measures they might be. Like the accident research data themselves, those from research into lasting effects of accidents will be automatically processed after coding and coupling. Collection of the data is expected to last until Autumn 1978. Several months will then be needed for processing, afterwards followed by analysis.

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**The lap belt also prevents severe head injury.** L.T.B.van Kampen. (Only in Dutch. SWOV, 1976)

**SWOV to examine 15,000 wrecked cars.** J.H Aarts & E Asmussen. (Only in Dutch. SWOV, 1976)

**SWOV researches lasting effects of accidents.** L T B van Kampen & W Clay. (Only in Dutch. SWOV, 1977).

# Safety on the road/ in a given area

*Polder roads long and straight but not always safe.*

It has earlier been stated that modern roads with separate carriageways (motorways) are much safer than single carriageway roads. They have no single-grade intersections and are accessible to fast traffic only. Mixed traffic roads, i.e. for both cars and cycles, mopeds and pedestrians make a substantial contribution to road hazards.
SWOV's research is aimed at systematic classification of the Dutch roads system into categories. A principal point of departure for this is the fact, obtained from practical research, that the form of a road greatly influences the road user's behaviour (as regards speed). Where possible, an effort will have to be made to bring the road's function within the traffic system into line with the design of traffic facilities. On roads with separate carriageways and wide lanes, a road user will generally expect higher speeds and make little allowance for slow or intersecting traffic. If such a road is outside the built-up area, it will rightly be looked upon as a motorway. In that event, unexpected traffic features (such as the presence of an agricultural vehicle) or sudden changes in road features (for example a sharp bend) should be avoided wherever possible. A wide road with separate carriageways and wide lanes inside a built up area, however, will wrongly create the impression of a motorway. Because design is not in line with its function, it will invite speeding.

# Road safety in Noord-Brabant

The number of road categories will have to be limited and be clearly distinguishable to road users. SWOV has designed an example of classification for the Dutch roads system. It has been put forward for discussion by roads authorities a.o. to get opinion-forming on the possibilities of such classification under way.

In 1973, SWOV began research into road safety in the Noord-Holland polder, the Beemster. The first part of this was completed with a final report presented in May 1976 to the Minister of Transport and Waterways. It contains recommendations for measures to improve road safety in the Beemster.
Within the road classification research, SWOV has also given instructions to catalogue a limited number of roads in Noord-Brabant as an experiment. Based on the experience gained with this, the initial phase of the definitive cataloguing will be proposed, only in Noord-Brabant for the time being.

Road safety in the province of Noord-Brabant came into the news partly owing to questions asked in Parliament.
The Provincial Council were of the opinion that Noord-Brabant was often painted too black as the province with the worst road safety. This led to them having scientific research carried out on the subject. This would also make it possible to lay down better priorities for allocating available funds.
In the first stage of the research SWOV gave a general description of road safety in the various Dutch provinces. This showed that Noord-Brabant cannot be marked as 'the' unsafest province in The Netherlands, though it is one of the most unsafe ones. This prompted a more detailed description of road safety in Noord-Brabant as compared with the rest of The Netherlands. On this basis, a number of areas requiring special attention were indicated, i.e. parts of the safety problem in which Noord-Brabant differs adversely from the rest of the country.
For the second stage, a selection was made from among these areas of those qualifying for further investigation. Based on this, and on existing knowledge, proposals will ultimately be made for measures that sould lead to an improvement of road safety.
The second stage has been commissioned by the Province of Noord-Brabant and the Ministry of Transport and Waterways. It will be carried out by the Provincial Public Works Department, Rijkswaterstaat and SWOV, with SWOV mainly functioning as the 'architect'.

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**Policy making on road design standards**. F C Flury. SWOV, 1976

**Design and classification of roads from the viewpoint of driving task analysis**. S T M C Janssen. SWOV, 1976

**Road safety in rural areas**. S T M C Janssen. (Only in Dutch: SWOV, 1976)

**Road safety in the province of Noord-Brabant I and II**. Research Noord-Brabant Stage I. Project team Noord-Brabant (project leaders H L Oei & H Hoek). (Only in Dutch: SWOV, 1976)

**Road safety in the province of Noord-Brabant III.** Research project Noord-Brabant Stage 2. Project team Noord-Brabant (project leaders H L Oei & H Hoek). (Only in Dutch: SWOV, 1976)

# Roadside obstacles

In 1974, 22% of all fatal road accidents were due to cars running off the road and hitting a roadside obstacle. To prevent such accidents in the future as much as possible, the Minister of Transport and Waterways set up a Working group to make recommendations for making Dutch roadsides as safe as possible. The research for this is being carried out by SWOV.

There are a number of ways to make a roadside safer. The most effective way seems to be to remove all roadside obstacles. But this method will be impossible in some cases because many such obstacles have a useful function. They may promote road safety, such as lighting columns, roadside telephones and direction signs, or may beautify the countryside, such as trees. If obstacles cannot be removed because they have a useful function, an effort can be made to take them less dangerous by building them of lighter material or designing them so that they readily yield when hit. Obviously, however, this is not possible for all obstacles (for instance trees). In such cases the dangerous obstacles can be shielded, for instance by building guiderail constructions. Lighting columns are the most common roadside obstacles and much of SWOV research so far has concentrated on these. Research into lighting columns consisted mainly of impact tests with cars at the 'De Vlasakkers' military proving

# Man-vehicle-road-traffic

grounds Amersfoort made available to SWOV by the Ministry of Defence Lighting columns of various materials and designs were tested. Impacts were made at different speeds and from different angles both head-on and sideways-on. In practice, a sideways-on impact generally has more serious consequences than a head-on impact. The sideways-on impact tests became possible because of a special testing installation developed by the Research Institute for Road Vehicles TNO, Delft. The Foundation Film and Science, Utrecht, filmed the impact tests.

Besides the direct danger to car occupants in impacts with a lighting column, SWOV also examined the danger to other road users of falling lighting columns.

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**Lighting columns.** Research on the behaviour of lighting columns in sideways and head-on impact tests with cars. C C Schoon and A Edelman. (In Dutch: SWOV, 1976; English version in preparation (1978))

**Hazards with falling lighting columns.** Considerations regarding the position of lighting columns being non-aggresive for private cars. C C Schoon and A Edelman. (In Dutch: SWOV, 1976; English version in preparation (1978))

In many cases, the subject of SWOV research will appeal to many people right away. Research into crash helmets and car seatbelts is clearly related for everyone to road safety. Research into drinking and driving is also clearly recognizable because the relationship between drinking and the increased accident risk needs little explaining. Theoretical research is different. But it is essential for SWOV because it forms the basis for practical research. Much of SWOV's theoretical research aims at discovering laws of individual and group behaviour by road users. In this framework, the following SWOV research projects are being carried out: Driving task analysis, Driver/vehicle cybernetic model and Traffic Flow Models.

Driving task analysis is aimed at discovering whether road users' possibilities and limitations enable them to carry out properly all the tasks necessitated by traffic. Such tasks are largely determined by characteristics of the road, the vehicle and the traffic. Modification of these characteristics might ease a number of the road users' tasks.

The Driver/Vehicle Cybernetic Model research is a logical follow-up of the Driving Task Analysis research. The cybernetic model assumes that driver and vehicle form a single system that can function correctly only if both components are attuned optimally to each other. With a simplified schematic description (model) of the system and its operation, it is hoped to find the limits within which the system is stable, what effect extraneous disturbances have, and so on.

The Traffic Flow Model research deals with the collective behaviour of the driver/vehicle system and endeavours to embody it in models. A traffic flow, the term is self-explanatory, is a series of (motor) vehicles moving in one or both directions along the road.
In the Traffic Flow Model research, the large volume of literature on this subject was first catalogued. It was next checked how much of it was important for road safety research. A knowledge of traffic flows is extremely important, especially in The Netherlands where more and more traffic has to use a barely growing roads system.
In designing a road, the basis is its function as part of the roads system of which it is planned to form part, the expected volume of traffic and the standards of traffic circulation. Many details of the design standards will be derived from the study of the interaction between a vehicle/driver combination and the road characteristics.
The requirements for the various road elements do not automatically indicate how the road as a whole must be consti-

*A signalling system may be a very effective means of preventing queues.*

tuted to arrive at the optimum design. In choosing their speeds, for instance, drivers apparently usually respond more to their overall impression of the road and surroundings than to the individual elements.

It is not yet known what road traffic behaviour is like if a part is played not only by the interaction between individual vehicles and the road but also between the vehicles themselves. Certain aspects of this behaviour are described by traffic flow models. Such a model is a theoretical construction comparing a number of data. If this datum is given than this is not possible, but that is.

The fundamental diagram describing relations between average traffic flow characteristics is a form of traffic flow model. This is a matter of relations between **intensity** (the number of vehicles passing a given point within a certain time), **density** (the number of vehicles present per road section) and **average speed**. These relations depend on the following characteristics: cross section, horizontal and vertical course and length of visibility. This dependence can be used in designing the road for inducing specific behaviour by the traffic flow. This is very important because there are more efforts than in the past to bring traffic flow behaviour into narrower margins fitting in with the type of road involved.

The fundamental diagram, represented

the relation in static conditions (i.e. conditions in which a certain equilibrium has been reached and which are constant for some time) between the volume of traffic and a characteristic speed of traffic on a road section, can be used for road design and traffic control measures. But further research is necessary because gaps still exist in knowledge of the fundamental diagram.

As the limited amount of public space in The Netherlands and in many other industrialised countries prevents unlimited expansion of the roads system, the growing number of cars makes it necessary to seek other means of guaranteeing road safety and traffic flows.

One such means is to install information and signalling systems. Their purpose is to inform drivers about situations and events beyond their immediate perception which might adversely affect road safety. They can also assist drivers to assess a given situation and to take decisions.

Some possible applications of such systems are: lane signalling, queue warnings, warnings of fog and slippery surfaces and incidents, inlet and exit control, homogenizing traffic flows, route indication and tunnel signalling. If a number of these functions can be combined in a single system, this is known as a corridor or extended signalling system. SWOV has undertaken literature research into the occurrence and functioning of such systems in other countries. The objective was to ascertain what systems could also be used in The Netherlands.

In addition, functional requirements were drawn up which signalling systems must meet to function as effectively as possible.

SWOV also prepared an evaluation scheme for a queue warning system which has already been installed at various places in The Netherlands. With minor modifications it can be used for evaluating other systems as well. Rijkswaterstaat is to install various signalling systems in The Netherlands, including the following motorways: A2 (Amsterdam-Oudenrijn-'s Hertogenbosch), A12 (The Hague-Oudenrijn-Arnhem) and A13 (The Hague-Rotterdam).

Variable recommended speeds are given on portals spanning the road at 500-metre intervals. In this way, drivers can be warned of sudden hold-ups and big differences in speed can be avoided. This could improve both traffic flow and road safety. The actual effect of signalling systems on traffic flow and road safety can be ascertained only by evaluating research. But this has hardly been done either in The Netherlands or in other countries.

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**The fundamental diagram**; A macroscopic traffic flow model. H Botma. SWOV, 1976

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**Traffic information systems**. H L Oei. (Only in Dutch: SWOV, 1976)

**Relevance of a number of foreign information systems for The Netherlands**. H L Oei. (Only in Dutch: SWOV, 1976)

**Scheme for evaluating a local queue warning system**. H Botma & H L Oei. SWOV, 1977

# White or yellow lights?

National and international debates occurred with a certain regularity on the question: what is better, white or yellow car head-lamps?
In 1976 SWOV issued a publication examining the tenability of all the arguments that have been put forward on this subject through the years in the literature. The final conclusion was that the colour of the light is irrelevant to all perceptive aspects of importance to motorised road traffic. White and yellow lights are of equal value.

In view of the interest in this study in other countries, an English version was published in 1976.

**White or yellow light for vehicle head-lamps?** Arguments in the discussion on the colour of vehicle head-lamps.
D.A. Schreuder. Publication 1976-2E, SWOV, 1976

# Traffic accident recording

As early as 1969, SWOV gave the impulse for an integrated accident recording system. This project comprises all activities aimed at bringing about national accident records for scientific research purposes. This envisaged limited basic records having access to other more detailed record systems such as hospital records, registration number records, car insurance companies' records, and so on. In this way, their use for research for a variety of purposes seemed assured, with duplication being avoided as much as possible.
Since national accident records established on the basis of police records make insufficient allowance for the requirements of scientific research SWOV looked for an alternative supplementary system in close co-operation with the Ministry of Transport and Waterways.

The Road Accidents Recording Department (VOR) was set up in Heerlen on 1st January 1975 under the administration of the Ministry of Transport and Waterways, as the initial step towards an integrated system. The intention is that the VOR, now under the jurisdiction of the Road Safety Directorate, should be available to all concerned in any way with road traffic and road safety.
The advantages of national accident records are clear:

- accident data are more accessible to a large number of users;
- computers process the data flow systematically;
- the records make for greater uniformity and co-ordination of data;
- duplication is avoided;
- they cost less;
- data and potential of other records ca be made use of;
- road accidents can be investigated better.

After analysis and study of centralised data, for instance, the influence of traffic measures, such as traffic signals, roadside safety barriers, road reconstructions, lighting etc. can be measured better.

**An integrated traffic accident recording system** (INVORS). Backgrounds and practical uses.
J.C.A. Carlquist. (Only in Dutch: SWOV, 1976)

# Accidents on wet road surfaces

Every motorised road user can be faced with the danger of skidding. This danger arises when the skidding resistance is no longer sufficient to carry out the desired braking and steering manoeuvres. The extent of skidding resistance, and especially temporary or localised decreases in this, are difficult for road users to judge. Skidding resistance decreases substantially if the surface is wet. Although The Netherlands are a rainy country, the average time of rainfall from 1941 to 1970 was only 6,2%. During this thirty year period, it can be estimated that road surfaces were not wet for more than 12% of the time.
While the surface is wet, the accident risk is on average twice as great as when the roads are dry.
Road surface properties have the biggest influence on skidding resistance. Other factors are driving speed, the thickness of tyre treads, the thickness of the water layer on the surface and tyre properties. This is one conclusion from the SWOV research into Tyres, Road Surfaces and Skidding Accidents. It also examines the best possible way of using the available friction between tyre and surface. This can be done by dividing overall braking power optimally over the various axles of the vehicle.

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**Traffic accidents and road-surface skidding resistance.** L.H.M.Schlösser, SWOV, 1976

**Tyres and road surfaces.**
L.H.M.Schlösser, SWOV, 1976

**Auxiliary brakes for trucks.**
L.H.M.Schlösser, SWOV, 1976

# Multiplicative analysis models

In 1966 SWOV set up a Work Group on Tyres, Road Surfaces and Skidding Accidents. Subcommittee V of this Work Group had the terms to reference to establish the extent of skidding accidents. It would also consider the part played by road-surface skidding resistance in accidents.
To investigate the extent of the skidding problem, accidents on dry and wet surfaces with and without rain were compared. The role of road surface skidding resistance was examined only as regards accidents during rainfall.
The Multiplicative Models study is concerned with describing applied analysis methods and the conclusions resulting from description about the relation between accidents, hourly traffic volume and road surface skidding resistance.
The analysis assumes that the volume of traffic can affect accident occurrence in two ways. On the one hand, more traffic will cause more accidents owing to the bigger number of road users: the exposure increases. One would also expect the accident rate to increase proportionately with traffic performance.
On the other hand, however, increasing hourly traffic volumes (for instance at peak hours) will also increase the risk of each individual road user being involved in an accident: accident susceptibility increases.
In the analysis, an adjustment was made for the degree to which exposure plays

a part. Accidents during a given time on a given road section were divided by the number of vehicle-kilometres travelled on that section during the period. These accident ratios were analysed for motorways and other motor roads.
To ascertain the effect of traffic volume on accident susceptibility this variable was used in addition to the adjustment for vehicle-kilometres to explain the difference in accident ratios. An endeavour is thus made to define the accident ratio as a function of both road-surface skidding resistance and hourly traffic volume.

It can be concluded that especially road-surface skidding resistance but also hourly traffic volume influence accidents on motorways. These influences act independently of each other. This means that for this category of roads the same norm can be used for road-surface skidding resistance regardless of traffic volume, but its effectivity does differ with the traffic performance.
For other motor roads, skidding resistance and to a less extent hourly traffic volume are of influence, but in this case the influences are not independent. The big differences in characteristics of roads in this category may explain this.
If vehicle involvement in accidents is also examined, it can be concluded that the foregoing applies not only to private cars but to trucks as well.

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**Multiplicative models of analysis.** A description and the use in analysing accident ratios as a function of hourly traffic volume and road-surface skidding resistance. S Oppe. SWOV, 1977

**The analysis of the number of passenger cars and lorries involved in accidents as a function of road-surface skidding resistance and hourly traffic volume.** S Oppe (1977)

Within the Organisation for Economic Co-operation and Development an important contribution is provided by SWOV.
SWOV is represented by its Director on the Steering Committee for Road Research, and SWOV workers are actively involved in a large number of Road Research groups.
SWOV workers contributed to the following OECD publications which appeared in 1976:
- Driver instruction (R.Roszbach).
- Polarized light for vehicle head lamps: Proposal for its public evaluation; The technical and behavioural problems involved. (D A Schreuder)
- Adverse weather, reduced visibility and road safety, Driving in reduced visibility conditions due to adverse weather. (D A Schreuder)
- Hazardous road locations, Identifications and counter measures. (S.Oppe)

In addition, the following contributions were made for forthcoming OECD publications:
- Accident Investigations. Working document for the first meeting of the OECD ad hoc Group on Multidisciplinary Accident Investigation Surveys (H G.Paar).
- OECD MAS questionnaire on accident investigation. (A Edelman)
- Summary of responses to a questionnaire. Working document for the second

meeting of the OECD ad hoc Group on Multidisciplinary Accident Investigation Surveys (MAS). (A.Edelman)
– Characteristics of accidents with two-wheeled vehicles. Contribution to OECD Research Group S13. (P.C.Noordzij)
– Integration of mixed traffic in the urban environment, general principles and strategies. Contribution to OECD/CEMT Special Group on Pedestrian Safety. (J.H.Kraay)
– Le cyclomoteur de faible puissance et son effet sur la sécurité routière. Contribution à OECD Groupe de Recherche S13. (A.Blokpoel en S.Harris, M.A.)
– The low-speed moped – Safe or not? Contribution to OECD Research Group S13. (A.Blokpoel en S.Harris, M.A.)
– Alcohol and road safety; Literature study (First draft). Contribution to OECD-Research Group S14. (P.C.Noordzij)
– Breath testing. Contribution to OECD-Research Group S 14. (P.C.Noordzij & J.A.G.Mulder)

Furthermore, the following papers were read at the Symposium on Methods for determining geometric road design standards 1976 held by the OECD in Denmark on 10th, 11th and 12th May 1976:
– The fundamental diagram, a macroscopic traffic flow model – by H.Botma;
– Policy making on road design standards – by F.C.Flury;
– Design and classification of roads from the viewpoint of driving task analysis – by S.T.M.C.Janssen.

At the fifth session of this symposium, Mr.Asmussen made a statement pointing out, inter alia, that when road design standards are drawn up or road classifications are made, it should be realised that this is done for the road users' benefit. It is therefore necessary to be able to predict road users' behaviour properly. In the past, road designers often used models in which the road user was regarded as a more or less independent element. His behavioural characteristics were assumed to be definable independently of the traffic situation. For instance, more or less constant response times, perceptive possibilities and so on were used for simplification. This has changed in recent years. But it is no easy matter to find a method of simple experimentation to determine a road users' behaviour. Behavioural scientists will have to be enlisted because they know how to measure behaviour. Engineers and behavioural scientists will have to work together in multidisciplinary teams. This view determined the course of the further discussions during the symposium and was adopted in the conclusions.

There has been a steady growth of the library collection year after year which means that the use of this collection specialised on road safety by researchers, students and other people from outside the institute has been increasing likewise from researchers from the SWOV itself.
The SWOV is a member of the International Road Research Documentationscheme (IRRD) of the OECD-Road Research Secretariat and as such responsible for the input of Dutch publications and information on current research – together with the Durch State Road Laboratory – into the scheme, and acting as a gatekeeper to the worldwide information accessible by this scheme.
Services delivered to the Dutch traffic scene are a.o.:
– On line retrieval in co-operation with the Scandinavian IRRD members.
– SDI-services.
– COM fiches.

# Published in 1976

**Reports 1976**

- De veiligheid van de voetganger I, Een literatuurstudie betreffende het effect van voorzieningen, wettelijke maatregelen en initiatieven, ondernomen om het onderlinge gedrag van voetgangers en overige verkeersdeelnemers te beïnvloeden. SWOV (J.H.Kraay, soc.drs.). R-76-1. SWOV, Voorburg, 1975/1976. 38 blz.*
- De veiligheid van de voetganger II; Een literatuurstudie betreffende het effect van maatregelen op het gebied van de stedelijke infrastructuur. SWOV (J.H.Kraay, soc.drs.). R-76-2. SWOV, Voorburg, 1975/1976. 45 blz.*
- Stalen en aluminium lichtmasten; Een nadere beschouwing van een aantal oriënterende botsproeven met personenauto's, die in opdracht van de Rijkswaterstaatswerkgroep Lichtmasten in 1971 gehouden zijn op De Vlasakkers' te Amersfoort. (Herziene versie). SWOV (D.R.J.Jordaan e.a.). R-76-3. SWOV, Voorburg, 1976. 54 blz.*
- Langzaam verkeer en de verkeersveiligheid, Een statistische beschrijving van in het verkeer gedode voetgangers, fietsers en bromfietsers in Nederland in de jaren 1968 t/m 1972. (Herziene versie). SWOV (J.H.Kraay, soc.drs. e.a.). R-76-4. SWOV, Voorburg, 1976. 64 blz.
- De verkeersonveiligheid in de provincie Noord-Brabant I en II; Onderzoek Noord-Brabant Fase 1 + Tabellen, Afbeeldingen en Bijlagen. Rapport t.b.v. Provinciale Waterstaat Noord-Brabant en de Stuurgroep van het project Noord-Brabant. SWOV (Projectteam Noord-Brabant). R-76-5. SWOV, Voorburg, 1976. 96 + 238 blz.*
- Evaluatie onderzoek met betrekking tot de verkeersongevallenregistratie (VOR), Beschrijving en resultaten van het Vooronderzoek Camets en de Proefregistratie Verkeersongevallen in de Provincie Utrecht. SWOV (A.Blokpoel e.a.). R-76-6. SWOV, Voorburg, 1976. 156 blz.*
- Voertuigverlichting binnen de bebouwde kom, De verlichting van de voorzijde van motorvoertuigen op wegen die van een openbare verlichting zijn voorzien. (Herziene versie). SWOV (Dr.ir. D.A.Schreuder). R-76-7. SWOV, Voorburg, 1976. 110 blz.*
- Analyse van kruistabellen; Log-lineaire Poisson modellen voor gewogen aantallen. J.de Leeuw (R.U. Leiden) & S.Oppe (SWOV). R-76-8. SWOV, Voorburg, 1976. 25 blz.
- Development of a conflict observation technique. Operationalisation, methodological problems and the use of the technique in two field situations in Delft. Contributed to OECD Special Research Group on Pedestrian Safety. V.A.Güttiger (NIPG-TNO) & J.H.Kraay (SWOV). R-76-9. SWOV, Voorburg, 1976. 80 pp.
- Verkeersveiligheid in plattelandsgebieden; Advies voor verkeersveiligheidsmaatregelen in de Beemster; + Tabellen en Afbeeldingen. (Herziene versie). SWOV (I.S.T.M.C.Janssen). R-76-10. SWOV, Voorburg, 1976. 67 + 31 + 43 blz.*
- The low speed moped, Safe or not?, The likely consequences upon road safety of introducing the low speed moped. Summary and conclusions from the Advisory report for the Minister of Transport and Waterways of The Netherlands. Contribution to OECD Research Group S13. R-76-11. SWOV, Voorburg, 1976. 10 pp.
- Le cyclomoteur de faible puissance et son effet sur la sécurité routière, Conséquences à prévoir pour la sécurité routière de l'introduction éventuelle du cyclomoteur de faible puissance. Resumé et conclusions du Rapport établi à la demande du Ministre de la Circulation et du Waterstaat. Contribution à OECD Groupe de recherche S13. R-76-12. SWOV, Voorburg, 1976. 10 pp.
- Het basisdiagram, een macroscopisch verkeersstroommodel. H.Botma. R-76-13. SWOV, Voorburg, 1976. 28 blz.

* Only in Dutch

- The fundamental diagram, a macroscopic traffic flow model. Paper and shortened version presented to the OECD Symposium on Methods for determining geometric road design standards 1976, Helsingør, Denmark, 10-12 May 1976. H.Botma. R-76-14. SWOV, Voorburg, 1976. 18 pp.
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